

NJ Affordable Green Case Study

Bellevue Court Microload Houses, Trenton, NJ

New Jersey's first urban microload affordable homes stand in Trenton, NJ. Part of the larger Bellevue Court Project, the dwellings at 233-235 Bellevue Court conceal leading edge technologies behind their traditional brick façades.

Spearheaded by the city of Trenton and developed by Isles Inc. and Tara Construction Management Corp. these microload homes are projected to use over 70% less energy than a code compliant home and 50% less energy than their Energy Star neighbors.



233-235 Bellevue Court Microload Houses

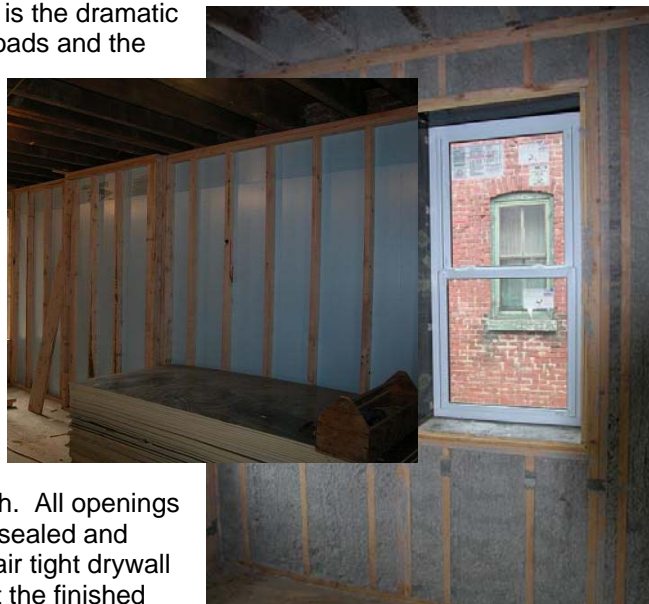
Green Features

The two 1700 square foot units have three bedrooms and two and one half baths. Sustainable and recycled materials were incorporated throughout the homes. . Please see the accompanying Bellevue Court Homes case study for more on these materials.

To help provide exceptional air quality in these air tight homes, mechanical ventilation is provided using a heat recovery ventilator (HRV). The exhaust vents from each bathroom and kitchen are ducted to the HRV while fresh air from the HRV feeds into the return plenum of the furnace.

Energy Features

The real breakthrough in these houses is the dramatic reduction of their heating and cooling loads and the ability of these homes to meet a substantial part of those loads with renewable energy. Heating and cooling losses were reduced through the building envelope with highly insulated walls and careful air sealing. The inside face of the existing masonry walls were covered in rigid insulation followed by a one inch air space and 2x4 framing. This assembly was then filled with damp spray cellulose achieving a whole wall R-value of 18.5. Attic insulation is R40 blown in cellulose and R40 rigid insulation on the attic access hatch. All openings in the thermal envelope were carefully sealed and gypsum board was installed using the air tight drywall approach. This created an air barrier at the finished wall surface. Air leaks that may have been missed during construction were revealed during blower door testing and sealed.



Rigid and cellulose insulation

Foil faced foam insulation surrounds each window's rough opening to reduce heat loss in an area that usually loses a lot of heat through thermal bridging. The windows themselves have fiberglass frames, which are well insulated and are much more durable than the typical windows used in affordable housing. The insulated glass includes a heat-saving low-e layer and argon gas fill.

Custom designed overhangs on the south wall of the microload homes block the high summer sun and allow for passive solar heating during the winter. The window glass was selected to allow solar heat to enter in winter. (Solar Heat Gain Coefficient of $>.6$.) As a passive cooling strategy a skylight with a hand held crank was placed over the central stair to allow for warm inside air to move up and out of the house in summer. This also provides daylight in the area.



**GFX drain water
heat recovery**

The reduced heating loads will be met with a 90% efficient sealed combustion furnace. Air conditioning will be provided by a SEER 13 1.5 ton unit. The duct layout to deliver the heated and cooled air was specially designed to minimize friction losses so that furnace fan energy will be reduced.

Hot water will be generated by a combination of a solar thermal system and a sealed combustion gas water heater. The solar system on the roof will preheat the water for the gas water heater. In addition a GFX heat exchanger will recover waste heat from the shower grey water. The combination of the solar thermal unit and the GFX is projected to reduce water heating energy use by over 70%.



South wall overhangs

A 2.5 kW photovoltaic array on the roof is projected to offset close to two thirds of the electric loads in the house. The system will be net metered, allowing unneeded solar-produced electricity to be sold back to the utility.

Buyers of the microload houses will receive training on all the special features of their homes. The energy use and production of the microload houses will be monitored for a period of three years by the New Jersey Green Homes office to track the efficiency and performance of the units. The active and thermal solar units will be inspected annually for a period of ten years. The microload houses will be sold for \$55,000 to homebuyers making 50% or less of the median income. Funding was provided by the city of Trenton, the Balanced Housing program, HUD HOME Grants, the Federal Home Loan Banks of New York and Pittsburgh, and the New Jersey Green Homes Office.

Lessons Learned

The contractor for this project found that many of the items used in the microload homes could not be obtained locally, "the toilet was from Australia, the HRV from Canada" so his lead time was longer and in the future he would know to plan for it. The cellulose insulation was a change from his normal practices, but he's sold on the acoustic performance of the product. "When you close the outside door in these houses, it's like being in a sound proof room". Other team members noted that it was difficult to combat a "rule of thumb" mentality for the sizing of heating and cooling systems. One consultant stated that only by insisting on Manual J calculations did they avoid installing a cooling system twice the size necessary. The developer noted that having the air sealing done properly was a struggle. He commented that "infiltration is one of the least understood aspects of building science". He went on to say that when team members were on site to observe blower door tests the importance of air sealing became very clear. Project Summary Bellevue Court Houses

OWNER/DEVELOPER

Isles Incorporation, 10 Wood Street Trenton, NJ 08618, Tara Construction Management 33 Rock Hill Road Bala Cynwyd, PA 19004

ARCHITECT

Frank Russo, Shapiro Petrauskas Gelber, 1524 Delancey Street Philadelphia, PA 19102

CONTRACTOR

Omega Corporation P.O. Box 2803, Bala Cynwyd, PA 19004

GREEN DESIGN CONSULTANTS

Lyle Rawlings, Advanced Solar Products, Inc.
Andy Shapiro, Vermont Energy Investment Corporation)

FUNDING – Microload houses are part of a 22 unit Bellevue Court project

City of Trenton	Donated the 22 units and provided \$1,000,000 Grant
Home Sales	\$1,397,000
NJDCA Balanced Housing	\$577,813 Grant
NJDCA HOME	\$556,500 Grant
NJDCA Green Homes Office	\$165,000 Grant
NJDCA Green Homes Office Microload Funding	\$132,000
Federal Home Loan Bank of New York	\$181,350 Grant
Federal Home Loan Bank of Pittsburg	\$258,650 Grant
Total	\$4,268,313

Please see the accompanying Bellevue Court Homes case study.

DEVELOPMENT TYPE

Rehabilitation of semidetached houses for home ownership

RESIDENT PROFILE

First time home buyer low to moderate income.

DENSITY

14 units per acre

DEVELOPMENT PROFILE

Type	#/Units	Approx. SF	Cost
3BR	1	1700	\$55,000
3BR	1	1700	\$72,000
4BR	10	1700 - 2200	\$55,000
4BR	10	1700 - 2200	\$72,000

CONSTRUCTION TYPE

Rehabilitated two family masonry and frame home

DEVELOPMENT COSTS

Property acquisition costs	66,000
Construction costs	3,467,620
Professional Services	196,000
Developer's Fee, other costs	538,693
Total	\$4,268,313
Professional Services	196,000

Please see the accompanying Bellevue Court Homes Energy case study.

Energy Efficient/Green features
Building Envelope
Walls - R-5 rigid insulation and damp spray cellulose, whole wall R-value of 18.5
Ceiling -R-40 blown in cellulose
Windows - fiberglass frame double glazed low e argon filled SHGC>.6
Exterior doors – insulated
Basement ceiling - insulated with R-19 encapsulated fiberglass
Air sealing measures - Air tight drywall approach. Non-expanding foam at door and window rough openings. Air sealing at basement ceiling
Mechanical systems, energy efficiency features
Heating system - 90% efficient condensing gas furnace
Air conditioning - 1.5 tons SEER 13
High efficiency sealed combustion gas water heater
Solar domestic hot water heating – 2 4'x8' collectors with an 119 gallon storage tank
Heat Recovery Ventilator
Automatic setback thermostat
Photovoltaic array 2.5 kW
GFX drain water heat exchanger
Appliances/lighting
Energy Star refrigerator and dishwasher
Indoor Lighting – 1 Energy Star light fixtures with compact fluorescent bulbs per room
Outdoor lighting - High efficiency lighting with motion sensor
Green/recycled materials practices
Recycling area provided in kitchen
Recycling storage area provided at rear or side of house
Jobsite recycling and reuse of materials during construction
Reuse of brick from site for pervious paving
Recycling of architectural elements that could not be reused on the project
Recycled content plastic/wood lumber for porches and decks
PET carpet
ACQ versus CCA pressure treated lumber
Indoor air quality measures
Zero and low VOC paints
Track off mat system at entry
Plywood kitchen cabinets
Low and non toxic wood finishes, caulks and adhesives
Wood flooring in living rooms and dining rooms, ceramic tile in kitchens and baths
Sealed combustion furnace and hot water heater
Ducted range hood
Ventilation to each occupied room, exhaust from moisture producing rooms
Water Conservation
Dual flush lower water use toilets
Low flow shower heads and faucets
Drought proof plantings and grasses in species native to the area
Rainwater collection for gardening
Transportation
Bicycle storage In basement with grade level exit or in shed
Public transportation accessible at Calhoun street, perpendicular to Bellevue Court

For more information contact:

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